FR1090004

Patent number:	FR1090004
Publication date:	1955-03-25
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Classification:	
- international:	***F16F1/376;*** **F16F1/36;**
- european:	F16F1/376
Application number:	FRD1090004 19530722
Priority number(s):	FRT1090004 19530722

Abstract not available for FR1090004

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Description of **FR1090004**

Arises. The present invention relates to the springs called to roll, likely to work to the COM pressure and/or with traction.

At present, the spiral springs are obtained by the simple helical rolling up of an elastic wire. This manufacturing process present of the serious disadvantages due to the creation of internal tensions resulting from the elongation of fibres from mÃ© tal, and this, whether helical rolling up is carried out hot or cold.

In addition, these springs, because same in the way in which they are obtained and from their conformation in helicoid, cannot be treated thermically, after helicoid rolling up, without this draft lying does not cause deformations and varied tions in dimensions of the spring.

It results from it to a serious difficulty each time the spring must, on the one hand, being obtained with very reduced tolerances of manufacture which are not compatible with a heat treatment after manufacture and, on the other hand, to function under conditions such as the heat treatment would be necessary. It is the case, in particular springs of distribution of the steam engines in which the springs working in the presence of vapor on heated and not being able to be treated after machining because of the tolerances required, are very quickly dÃ©tÃ©rio abstr. and broken.

Moreover, the helical springs present, for certain applications, the serious disadvantage that their ends, on the one hand, are not parfai tement plane and, on the other hand, can undergo, one compared to the other, of displacements of transla tion side.

The present invention has as an aim a spring which does not present the disadvantages above.

This spring is remarkable in particular in what it is consisted a bar in a material Ã©lasti that, axially bored longitudinal hole dÃ©bou song with at least of the ends and in which notches forming of the slits are spared trans versales which emerge in the aforementioned longitudinal hole, these slits being shifted the ones compared to the others, in the longitudinal and peripheral direction, so as to let remain between them year minus a series of elastic blades connected between them as a guy zag.

This spring has the principal advantages sui vants It can be treated before machining in order to avoid the deformations due to the treatment, which allows ob to hold of the springs which, at the same time, has very precise dimensions and shows high characteristics at the point of view of the quality of elastic material used (steel, bronzes, superpolyamides, rubber, etc.) ; The ends of the spring can be machined mechanically and to be then perfectly drawn up, threaded, to be slotted, keyed, etc, if it is necessary; It is opposed to any displacement of relative translation latÃ© rale of the ends; It gives a curve of the variation of the arrow according to the effort which can, at will, by the choice of the slits and of their distribution, being either a line, or very curved desired; It has one clean period of asynchronous vibration, so that it does not enter in resonance, which makes it possible to make it function at high speed; Il presents an about null hysteresis; Il can constitute a remarkable universal joint. Other characteristics and advantages will result from the description which will follow.

With the annexed drawing, only given by way of example fig. 1 of rise in a spring sui vant is a sight the invention; Fig. 2 is a transverse section according to line 2-2 of the fig. L; Fig. 3 is a sight of rise in another mode of realization in the spring; Fig. 4 is a cut according to line 4-4 of the fig. 3; Fig. 5 represents, of rise, a third mode of realization of the spring; Fig. 6 is a cut according to line 6-6 of the fig. 5; Fig. 7 represents another spring according to in vention, equipped with oblique slits; Fig. 8 and 9 are sights partial of other alternatives; Fig. 10 is a sight in prospect for a prismatic spring of form; Fig. 11 represents, of rise, a spring in which the slits have widths and draws aside ments gradually increasing of an end of the spring to the other, for obtaining a curve arrow-load of parabolic or similar form; Fig. 12 and 13 represent, of rise, with partial cut, two applications within the competence of the fig. 3 and 4 taken by way of example, respectively like obstinate and universal joint; Fig. 14 is a diagram which gives, in abscis its, the arrows F in mm according to the loads P in kg, carried in ordinates, in the case of a LMBO leaves according to the

fig. 3 and 4, the various curves corresponding to various types of steel and to diffÃ© rents treatments.

According to the example of execution represented with the fig. 1 and 2, the spring is consisted a bar 1 in any of elastic materials indi quÃ©s higher made of a section of tube whose cylindrical surfaces external 2 and intern 3 are cylindrical and concentric with the longitudinal axis XX. In this bar are spared, with the cutter, two series of transverse slits 4 and 5 whose faces are perpendicular to axis XX.

The slits of the two series are diametrically opposed, in plan, as one can see it on the fig. 2 and, moreover, in the longitudinal direction, the slits are alternate from one series to another so that these slits spare between them blades 6 of curvilinear form, connected in zigzag by the por tions 7 not crossed having the shape of curvilinear triangles. Two annular surfaces of extrÃ© mity 8 and 9 of the spring are drawn up perfectly and parallel.

As it is included/understood, when this spring is subjected to a compressive force applied to the faces of end 8 and 9, blades 6 dÃ©for lies oneself elastically in inflection and torsion. The ensem corn of the spring decreases length, however that on the contrary, a traction exerted on the ends of the spring would cause elastic strain reverse blades 6 and the lengthening of this spring.

The example above represents a simple mode of exÃ©cu tion of the invention. The fig. 3 and 4 in reprÃ© feel a procedure preferred. The spring is consisted a bar tubulaire<B>II</B > on surfaces external 12 and intern 13 cylindrical and coaxial and, in this bar, are spared four series of slits 14, 15, 16 and 17.

These slits are laid out per pairs (14-I5 or 16-17) in the same transverse plan, the two slits of the pair considered being symmetrical compared to a diametrical plan YY for each pair 14-15 and ZZ for each pair 16-17. The two symmetry planes YY and ZZ are perpendicular between them, the slits of the same pair are separated by two massive parts 18 or 19.

The alternative represented with the fig. 5 and 6 comprises, in external bar 21 on always cylindrical and coaxial surfaces 22 and intern 23, six series of slits 24, 25, 26, 27, 28<I>et 29, </I > slits 29 being visible on the fig. 6. These slits are laid out by three (24, 25, 26) or (27, 28, 29) in the same transverse plan and these slits have a peripheral development slightly lower than 120 for mÃ©- to swim between them of the full parts such as 30.

In the three examples above, the slits were supposed to be perpendicular to the longitudinal axis of the bar.

The fig. 7 represents, by way of example, only one alternative in which bar 31 comprises slits, in the species two series of slits 32 and 33, symmetrical compared to an axial diametrical plan perpendicular to the plan of the fig. 1 and obliques with the longitudinal axis XX and the diametrical plan, the average plan such as < RTI WW of each slit being at the same time oblique to axis XX and perpendicular to the longitudinal axial plan which passes by the medium of this slit and which is confused with the plan of this figure.

In all the preceding examples, the bar has a cylindrical form.

The fig. 8 represents a truncated bar 41 of form, its faces intern 42 and 43 having their parallel generators. In this example. the LMBO fate comprises four series of slits, distributed like those of the example of the fig. 3 and 4.

The fig. 9 represents another alternative in which the bar 51, which is equipped with slits Ã©ga lement distributed as on the fig. 3 and 4, COM carries an external surface 52 truncated, boring interns 53 being, on the other hand, cylindrical.

The bar, instead of being cylindrical or tron conical, could still be prismatic or in truncated pyramid.

The fig. 10 represents a prismatic bar 61 of form, square cross section and, in this bar equipped with a hole square amusement 63, are spared four series of slits 64, 65. 66 and 67, as in the example of the fig. 3 and 4.

In all the examples which have been just described, the slits have the same width and are equidistant. These slits make it possible to obtain, in this case, as one will return one variation further there from the

arrow proportional to the load, but this provision is not exclusive and, by a different distribution of the slits, for example a variation of their draws aside lies and/or of their width, it is possible obte to nir any wished variation, nonlinear, of the arrow according to the load.

Thus with the fig. 11, one represented an alternative of spring of the type of the fig. 3 and 4, but in which bar 71 comprises four series of slits including three 74, 75, 76 are visible on the figure. These fÃ©ntes has widths which vary value gradually have with the value a2, however that their spacing varies progressive lies of b1 with b2.

Of course, and like already specified, one can exploit the width at will has slits and/or on their spacing B.

The springs which have been just described and their possible alternatives can be used either as springs themselves for example, as LMBO leaves device of injection of pump or engine, as return spring of valve for locomo tives destinies in particular to work out of overheated vapor, in which case the spring will be treated before the milling of the slits, which will avoid any deformation of this spring, as comes out from known pension of vehicles, in measuring apparatus of precision such as accelerometers, dynamometers, brake testing machines, etc.

The spring can amusement being used because owing to the fact that its two faces of end, perfectly plane, can be machined and do not undergo, during the deformation of the spring under the action of axial tank ges, any side displacement, but only lies of axial displacements of translation, like thrust, for example as bearing thrust ball as it is represented with the fig. 12 where a RI spring of the type of the fig. 3, but with a greater number of slits, comprises, in its face of end 77, a track 78 for balls 79, on which support a second Ã©hemin takes constituted by a crown 80.

The spring can still be used as universal joint and such an application is represented to the fig. 13 where the R2 spring of the type of the fig. 3 and 4 is used to elastically join together two rods or other elements 81 and 82 whose ends tubu laires and tapped into 83 and 84 are screwed on threaded ends 85 and 86 prolonging at its two ends the R2 spring.

This spring constitutes at the same time a connection Ã©las tick in the longitudinal direction and allows, moreover, with the two elements 81 and 82 which it connects to oscillate one compared to the other around the fictitious center 0.

One will refer now to the graphics of the fig. 14 which, like one specified it, gives in fonc tion loads P in kg carried in ordinates, the arrows taken by the spring with compression F in mm carried in X-coordinates in the case of a spring of the type of the fig. 3 and 4.

It is represented four curves or series of curves I, II, III and IV correspondent with four samples indicated by same references I, II, <B>111</B > and IV.

These four curves relate to springs of the type of the fig. 3 and 4 and having same the dimen sions (except for (thickness of the blades of sample IV) and differing the ones from the others only by nature from steel used and/or are draft lies thermal. Dimensions of the four Ã©chantil let us lons tested were as follows external DiamÃ¨tre: 35 mm; Internal diameter: 25 mm; width of the grooves: 2 mm; Thickness of the blades between the grooves For samples I, II, III: 1,5 mm, For sample IV: 1 mm; Width of the parts full 18 and 19 in end with the slits: 2,5 mm.

With regard to steels and their treatment Sample I. - Steel says 14 to manganese having the following composition, iron and in Carbone weight: 0,4 to 0,6 1o; Mn: 0,30 to 0,60; P: < 0,04; S: <:0,04.

This steel, untreated, is with the state so that its characteristics are as follows the R 60 5 kg;!mm2; E - 34 2 kg/mm'; A@@-:16. Sample II. - Even steel that sample I after the stabilizing treatment according to Annealing at 800/850 C; Soaked with hot oil; Slow cooling with the air, having given R = 65/70 kg;/mm2.

Ã‰chantillon<B>111.</B > - Steel with nickel-chromium of following composition apart from iron and in weight Carbon: 0,28 to 0,35; Mn: 0,40; Ni: 2,6; Cr: 0,70; P and S: < 0,03, before undergone the following treatment - Oil hardening 850 C; Totaled 650 C, such as its characteristics - 85 kg/mm2 are as follows the R; E _ - _ 75 kg/mm2; < I>A</I > lo - 12 kg/min2.

Sample IV. - Even steel and even draft lie that for sample II, this sample IV not differing from sample II,

one recalls it, that by the thickness of the blades (I mm instead of 1,5 mm). This posed, one will refer to the diagram of the fig. 1.

Curve I related with sample I comprises two very brought closer branches and very sensitive lies rectilinear which correspond, branch OAB with the compression of the spring and branch BCO with the relaxation of this spring.

It is noted that On the one hand, these two curves are very sensitive lies rectilinear, so that the variation of the arrow according to the load is very sensitive lies linear; And, in addition, the two curves are very voi sines one of the other, so that the spring has a very low hysteresis.

Curves II relating to sample II per put the same observations, the curve supÃ© rieure corresponding to the compression of the spring and the lower curve corresponding to the relaxation. These two curves are appreciably rectilinear juices that at the point E which corresponds to a crushing such of the spring which the blades came in contact. From this moment, it is obvious that the arrows vary much less according to the load, from where raised part EF, moreover without interest will pra tick, of the curve.

Curve III relating to sample III shows that until the contact whorls (not G), the two curves of compression and relaxation are superimposed exactly, the spring not having rigorously any hysteresis, part GH without interest corresponding to the whorls in contact.

The same observations can be made on curve IV relating to sample IV.

The whole of the curves above, quine reprÃ© smells besides that some of the tests effec killed by the applicant, one can conclude from it that with of the same slits cÃ©es thickness and regularly espa have. The deformation of the spring is linear, in by ticulier owing to the fact that all the bending blades are identical and that one does not have any more the effect said K of ap pui due, in the usual helical springs, with the form in bevels of the ends of the spring, forms which, by the initial bending of bevels, per turbe the law of bending which ceases being linear; B Hysteresis is about null; C. The quality of the metal and its modulus of elasticity only return concerned; D. Flexibility seems to be a direct function of the moment of inertia.

Experiments made up to now, it appears that, when the report/ratio of the radial width of the blades to the external diameter of the spring increases, the COM portement spring approaches that of an ordinary blade working with the inflection. More, on the contrary, this report/ratio decreases, more the torque increases in the blades and more the behavior of the spring approaches that a spring consisted a rectangular wire working with torsion.

The experiments showed that, on the other hand, the variation of the width report/ratio of the blades on thick sor of the blades does not have a great influence.

Il results from considerations above that, in the case of springs in conformity with the samples in which the report/ratio of the width of the blades to the dia meter of the spring is equal Ã /ou of about 6, one can base oneself, for calculation from spring, on two laws following (1) and (2), which give, respec tivement, the value of the load P in kg which horn respond with (total crushing of the spring and the value of the arrow F in mm for the load P given
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In these formulas RP is the stress of metal in kg/mm =; < RTI Rm is the average rate of neutral fibre of the LMBO leaves; N is the number of blades lain each one between two successive supports; h. is the thickness of the blades; B is the width of the blades; E modulus of elasticity, compression/traction; I moment of inertia of the section of the blade. Naturally, the invention is by no means limited to the procedures and the data above, which were provided only by way of example. In all the procedures represented, the bar is longitudinally bored right through, but, possible lies, its axial hole could be one-eyed.

Fig. 1

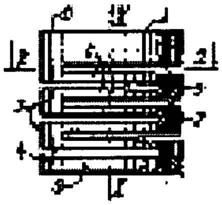


Fig. 3

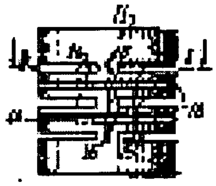
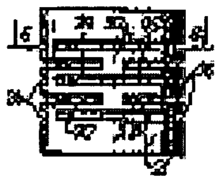


Fig. 5



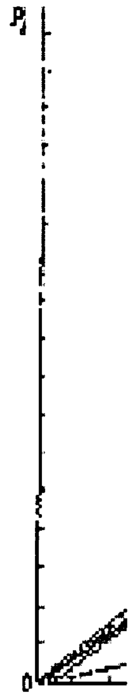


Fig. 2

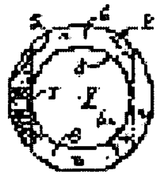


Fig. 4

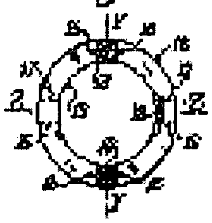


Fig. 6

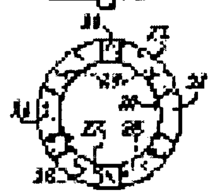


Fig. 7

Fig. 8

Fig. 9

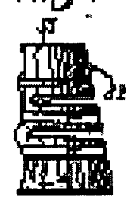


Fig. 11

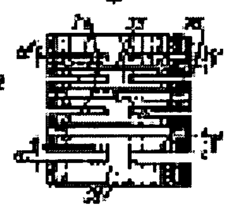


Fig. 10

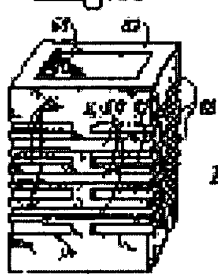


Fig. 12

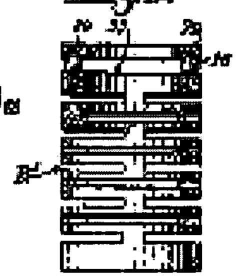


Fig. 13